行政院國家科學委員會補助專題研究計畫成果報告

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行政院國家科學委員會專題研究計畫成果報告
國際代工、海外行銷與補貼
International Subcontracting, Overseas Brand Creation, and Subsidies

計畫編號：NSC 89-2415-H-032-028
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1. Chinese Abstract

本計畫利用一個獨占競爭的二國二財一般均衡模型，採用事後(*ex post*)代工的概念，研究政府是否應補貼海外行銷以及補貼能否提高海外行銷。本文証明提高海外行銷會降低代工產量，提供政府補貼的誘因。再者，本文發現當海外需求的行銷彈性以及代工財之邊際損失的邊際變動夠大時，海外行銷會提高本國福利水準。此外，本文顯示，若海外需求的行銷彈性以及海外需求的之斜率的行銷彈性的加總小於一時，補貼會提高最適海外行銷水準。

關鍵詞：事後代工、海外行銷、補貼、獨占競爭

Abstract

This paper examines whether the governments should subsidize overseas brand creation and whether subsidies could raise overseas brand creation by using a two-country, two-good general equilibrium model with *ex post* subcontracting, in which monopolistic competition is taken into account. This paper has shown that overseas brand creation definitely harms the production of subcontracting, which gives governments an incentive to subsidize. In addition, it has found that when the brand creation elasticity of overseas demand and the marginal change of the marginal loss from subcontracted product are large enough, overseas brand creation improves the host country's welfare. Furthermore, it has also demonstrated that subsidies raise the optimal level of overseas brand creation, if the sum of the brand creation elasticity of overseas demand and that of the slope of overseas demand is no greater than one.

Keywords: *Ex Post* Subcontracting, Overseas Brand Creation, Subsidies, Monopolistic Competition.

2. Introduction and purposes

Overseas subcontracting is commonly employed in developing countries. For a specific example, Taiwan is the world's largest subcontractor in many industries, such as PCs and semiconductor foundry. Earlier literature on subcontracting includes Kamien, Li, and Samet (1989), Lewis and Sappington (1991), Spiegel (1993), and Taylor and Wiggins (1997). In particular, Spiegel (1993) points out, when there occurs considerable uncertainty about either the demand for downstream product or the marketing cost, which can be learned only when they actually set their downstream quantity, the firms may wish to postpone their subcontracting decisions *ex post*. Spiegel further argues that although contracts are usually set in the first stage while quantity and price are determined in the second stage in the industrial organization literature, the *ex post* subcontracting is proper and fits the reality of subcontracting industry.

Many subcontracting producers in developing countries can only export subcontracted products due to the lack of financial support to conduct overseas brand creation. They often suffers from the risk of being taken away the subcontracting task suddenly and are forced to drop out of the market. Especially, producers whose only

job is to subcontract for foreign producers are risk-taking. Some prime contractors perceive subcontracting as an intermediate solution for gaining time to set up their own supply base, and subcontractors will lose the subcontracting contracts immediately while losing cost advantage. Subcontractors could survive while losing subcontracting task only if they can also sell with own brands overseas. This can be seen in the case of the racket industry in Taiwan. Taiwan once was the major subcontractor for racket products. A rising cost during 1980s made Taiwan lose most of the subcontracting contracts. The only survivor, Kennix, is an international brand created by local producer. This example demonstrates the importance of creating overseas brand for subcontracting producers. However, the issues on whether the governments should subsidize overseas brand creation and whether subsidies could raise the optimal level of overseas brand creation have not been touched upon.

We thus develop a two-country, two-commodity general equilibrium model with *ex post* subcontracting, in which monopolistic competition is considered, to examine the effects of overseas brand creation on the subcontracted quantities and the welfare as well as the effect of subsidies on the optimal level of overseas brand creation. In this paper, we use a rise in overseas marketing cost to represent overseas brand creation, which can increase firm's overseas demands by enhancing the attraction of the host firm's product to foreign consumers.

3. The basic model

Suppose that there are two countries in the world: the host country and foreign country. Foreign variables are indicated with an asterisk (*). Each country consists of two industries: the differentiated product X that is produced with increasing-returns to scale, and the homogeneous product Y with constant-returns to scale technology. The production of differentiated product X consists of an upstream process and a downstream process. Firms produce and subcontract the production of good X in the upstream market, while market them in the downstream market. The host country is endowed with L units of labor. The representative individual receives only labor income, and has the form of Cobb-Douglas preference. The preference can be represented by an expenditure function $Q_x^{¥} Q_y^{1-¥} V$, in which V denotes the utility level, Q_x is the price index of the differentiated good, Q_y is the price of good Y, and ¥ (1-¥) is the share of good X (Y) in consumer's expenditure. The budget constraint can be described as:

$$wL - snA = Q_x^{¥} Q_y^{(1-¥)} V, \tag{1}$$

where w represents the wage rate, s denotes the specific subsidy rate to overseas brand creation, n is the number of variety produced in the host country, and A is the level of overseas brand creation. We define that A is represented by overseas marketing cost. The higher the level of A is, the stronger the attraction of the brand to foreign consumers will be. The initial value of s is assumed to be zero, and the amount of snA represents the government's total amount of subsidies to overseas brand creation.

Industry X produces a number of varieties of differentiated products, which are aggregated by a CES subutility function into a composite good. The price indices of the composite good in the host country and foreign country are Q_x and Q_x^*, respectively, which take the form:

$$Q_x = \left[np^{1-±} + n^*(p^*)^{1-±}\right]^{1/(1-±)}, \tag{2a}$$

$$Q_x^* = \left[n^*(p^*)^{1-±} + np_z^{1-±}\right]^{1/(1-±)}, \tag{2b}$$

where p_z denotes the shadow price of the host country's differentiated good consumed in the overseas market, and p represents the price ratio of the host country's differentiated good. In the symmetric equilibrium, the differentiated products are sold at the same price p and p^* in the host and foreign countries, respectively. We assume that there is no transport cost while shipping products domestically and overseas. Variable ±, which is greater than one, is the elasticity of demand for each differentiated product.

Following Stigler and Becker (1977), we assume that foreign households have the

utility function $u^*(n^*d_x^*, nz^*, Y^*)$, where $n^*d_x^*$ denotes the aggregate demand for foreign differentiated products, and z^* is a commodity consumed by the household and produced by it via a household production function. This production function uses the overseas purchase of the host firm's differentiated product x^f and overseas brand creation A as inputs. This means that the attraction of the host firm's product to foreign consumers goes higher via increasing overseas brand creation. Moreover, we assume that the quantity of x^f is not zero when A equals zero, i.e., the host firms can still sell products overseas without brand name. Thus, the household production function is specified as follows:

$$z^* = g(A)\, x^f, \tag{3}$$

where $g(0) = 1$, $\partial g/\partial A = g_A > 0$, $\partial^2 g/\partial A^2 = g_{AA} < 0$.

Like Stigler and Becker (1977), the relationship between the price ratio of host firm's product and its overseas shadow price can be derived from equation (3) as:

$$p_z = p / g(A). \tag{4}$$

Assume that industry Y is perfectly competitive, and employs only labor with constant-returns to scale technology. By choosing good Y to be the numeraire, the price of good Y, Q_y, can be normalized to unity. Choosing units such that one unit of labor produces one unit of output, the zero-profit condition is:

$$w = Q_y \equiv 1. \tag{5}$$

A two-stage game is constructed in this paper. In stage 1, firms engage in a Cournot competition in the downstream market. In stage 2, firms sign a subcontracting agreement, according to which the host firm produces x^s units for the foreign country's firm and in return receives a transfer payment T. Following backward induction, the analysis begins by considering the decisions in stage 2 -- the upstream subcontracting stage. Since firms' downstream quantities have been given by stage 1, the subcontracting moves some production from the higher marginal production cost firm to the lower marginal production firm to save costs. Through Nash bargaining solution, the maximum joint cost saving (i.e., the minimum joint upstream cost) is achieved by subcontracting, and is split according to each one's bargaining power.

The upstream production cost of differentiated product X is assumed to use only labor with increasing-return to scale, and involves a fixed cost ~ and a constant marginal cost . The upstream production cost can be expressed as:

$$l_x = \sim + \quad x, \tag{6}$$

where l_x is the workers employed in producing individual firm's differentiated product, and x is the host firm's downstream quantities.

A switching cost occurs when the firm takes up subcontracting production. The switching cost is assumed to increase the subcontracting firm's marginal upstream cost by fx^s for simplicity, in which f is a positive constant. Note that this assumption is necessary for deriving an interior solution. Otherwise, foreign firm will produce nothing. Thus, the subcontracting firm's upstream production cost including the switching cost is:

$$l_x = \sim + (\quad + fx^s)(x + x^s), \tag{7}$$

where x^s denotes the host firm's subcontracted quantities.

The subcontracted quantity is decided by minimizing the two firms' joint upstream production costs as:

$$+ fx + 2fx^s = \quad ^*, \tag{8}$$

where * represents foreign firm's constant marginal cost in the upstream process. The left-hand side (LHS) of (8) represents the marginal subcontracting cost for the host firm, while that for foreign firm is on the right-hand side (RHS).

The surplus that subcontracting production generates, S, is defined as:

$$S = (\quad ^* - \quad)x^s - fx^s(x + x^s). \tag{9}$$

The surplus, incurred by the cost saving due to subcontracting production minus the switching cost, is split according to the subcontracting agreement, in which the surplus is divided into proportions γ and $1-\gamma$ for the subcontractor and the consignor. The transfer payment from the consignor to the subcontractor is a weighted sum of host firm's incremental costs and foreign firm's

cost saving due to subcontracting, which is derivable as:

$$S = (\quad^{*} - \quad)x^{s} - fx^{s}(x + x^{s}). \quad (10)$$

The downstream production costs include the cost of a sales network and overseas brand creation. The host firm's profit Π^{x} is defined as the sum of revenues from downstream quantities, transfer payments from subcontracting production, and government subsidies, after subtracting the downstream production costs, the upstream production cost, and the switching cost for subcontracting.

$$\begin{aligned}\Pi^{x} &= px - mx - (1-s)A - [\sim + (\quad + fx^{s})(x + x^{s})] + T \\ &= px - mx - (1-s)A - (\sim + \quad x) + \tfrac{1}{2}f(x^{s})^{2},\end{aligned} \quad (11)$$

where m denotes the cost of sales network per unit of downstream quantity. The first four terms on the RHS of (11) represent the profits from downstream product, while the last term is the profits from subcontracting production.

With Cournot quantity competition, the host firm's profit-maximizing condition for downstream quantity in the downstream stage is:

$$p(1 - \frac{1}{\pm}) - (m + \quad) - \tfrac{1}{2}fx^{s} = 0. \quad (12)$$

We define the first and second terms on the LHS of (12) as the marginal gain from downstream product due to a rise in the downstream quantity, while the third term as the marginal loss from subcontracted product. We see from (8) that a marginal increase in downstream quantity decreases subcontracted quantities. This will result in the reduction in the profits from subcontracting, and then make a marginal loss from subcontracted product.

From the expenditure functions of the host country and foreign country, we can derive the following demand functions for the host firm's differentiated product:

$$d_{x} = Q_{x}^{\pm-1} p^{-\pm} ¥(wL - snA), \quad (13)$$

$$z^{*} = (Q_{x}^{*})^{\pm-1} p_{z}^{-\pm} (¥w^{*} L^{*}), \quad (14)$$

where d_x denotes the domestic demand for the host firm's differentiated product.

By equalizing the demand and supply of the host firm's differentiated product, we obtain the equilibrium condition as follows:

$$px = \left\{\frac{¥(wL - snA)}{n + n^{*}(p^{*}/p)^{1-\pm}}\right\} + \left\{\frac{¥w^{*}L^{*}}{n + n^{*}(p^{*}/p_{z})^{1-\pm}}\right\}. \quad (15)$$

Since there is no barrier to entry and exit in the differentiated-product industry, a zero-profit condition is required in the long-run equilibrium.

$$px - mx - (1-s)A - (\sim + \quad x) + \tfrac{1}{2}f(x^{s})^{2} = 0. \quad (16)$$

We assume that the host country is small, implying that it faces a given number of foreign differentiated products, and a given price ratio of foreign differentiated product. The model consists of (1), (2a), (4), (5), (11), (12), (15), and (16).

4. The extended model

To examine the impact of subsidies on overseas brand creation, we need an extra condition, which endogenizes the optimal level of overseas brand creation by maximizing the firm's profits with respect to A as:

$$p_{z}xg_{A}(1 - 1/\pm) = 1 - s. \quad (23)$$

The term on the LHS of (23) represents the marginal revenue of overseas brand creation MR^{A}, while that on the RHS denotes the marginal cost MC^{A}.

Totally differentiating (8), (12), (15), (16), and (23), we yield:

$$\begin{bmatrix} R_{p} & R_{n} & -p & 0 & -R_{A} \\ x & 0 & p - m - & 2\tfrac{1}{2}fx^{s} & -1 \\ 1 - 1/\pm & 0 & 0 & -\tfrac{1}{2}f & 0 \\ 0 & 0 & -1 & -2 & 0 \\ 1/p & 0 & 1/x & 0 & B_{A} \end{bmatrix} \cdot \begin{bmatrix} dp \\ dn \\ dx \\ dx^{s} \\ dA \end{bmatrix} = \begin{bmatrix} \sim_{ds} A\,ds \\ -A\,ds \\ 0 \\ 0 \\ -ds \end{bmatrix}, \quad (24)$$

where $B_A = -(£ + ¤)/A < 0$, $¤ = -(\partial g_A/\partial A)(A/g_A) > 0$ represents the brand creation elasticity of the slope of overseas demand, and let J_s denote the determinant coefficient matrix in (24). In addition to the stability conditions derived in (17), we derive an extra condition $J_s = -R_n\,[(-1/p)\tfrac{1}{2}f + (2/x)(1-1/\pm)] + B_A J < 0$ (See Appendix).

5. Concluding remarks

Subcontracting production is a commonly used production method in developing countries. In general, subcontracting producers usually fall short of the capability of creating brands overseas. This leads to an important question: whether the governments should subsidize overseas

brand creation. This paper have examined whether the governments should subsidize overseas brand creation and whether subsidies could raise overseas brand creation by using a two-country, two-good general equilibrium model with *ex post* subcontracting, in which monopolistic competition is considered. We have derived several striking results.

Firstly, we have shown that overseas brand creation definitely decreases subcontracted quantities. This gives governments an incentive to subsidize the subcontracting producers such that the firms will not be discouraged to engage in overseas brand creation. Secondly, overseas brand creation improves (deteriorates) the host country's welfare if the brand creation elasticity of overseas demand and the marginal change of the marginal loss from subcontracted quantity are large (small) enough. The government should subsidize overseas brand creation only when it can increase the host country's welfare. Lastly, we have shown that subsidies to overseas brand creation would not necessarily raise the optimal level of overseas brand creation. The optimal level rises if the sum of brand creation elasticity of overseas demand and that of the slope of overseas demand is no greater than one.

6. Self Evaluation

This project has completed all the items listed on the proposal. The results that we find are striking. This project could be reedited and submit to academic journals in the future.

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